PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-291951
(43)Date of publication of application : 26.10.1999

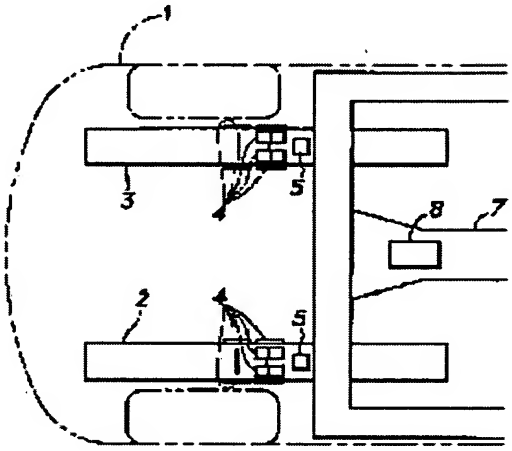
(51)Int.CI. B62D 25/20
B62D 21/00

(21)Application number : 10-091552
(22)Date of filing : 03.04.1998

(71)Applicant : HONDA MOTOR CO LTD
(72)Inventor : URUSHIYAMA YUTA
HIGUCHI HIDEO

(54) CONTROL DEVICE FOR CAR BODY RIGIDITY

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a car body rigidity control device which can absorb shocks properly irrespective of the style of car collision.
SOLUTION: A car body rigidity control device comprises a left and a right frame rigidity adjusting means 4 which are installed on a left 2 and a right side frame 3, respectively, extending fore and aft of the car and adjust the rigidity of the side frames, and a control means 8 which controls the operation of the rigidity adjusting means according to the collision style judged on the basis of the output of a collision sensing means 5 such as acceleration sensor. Thereby each side frame is adjusted into a rigidity suitable for the applicable collision style, and proper shock absorbing performance is exerted in any style, whether total collision or partial.



LEGAL STATUS

[Date of request for examination] 27.11.2001

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] The body rigidity control unit characterized by having the frame rigidity adjustment means of the right and left with which the side frame of the right and left which extend in the cross direction of a vehicle is equipped, respectively, and which adjust the rigidity of the side frame of these right and left, and the control means which control operation of the frame rigidity adjustment means of the aforementioned right and left according to the collision form judged based on the output of a collision-detection means.

[Claim 2] The body rigidity control unit according to claim 1 with which the aforementioned frame rigidity adjustment means is characterized by being the solid-state-component actuator which generates the load of the sense which is suitable or promotes which restrains deformation of the aforementioned side frame.

[Claim 3] the reinforcement which can be displaced between the position where the aforementioned frame rigidity adjustment means raises the rigidity of the aforementioned side frame, and the position which does not influence the rigidity of this side frame -- the body rigidity control unit according to claim 1 characterized by being a member

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the body rigidity control unit which controls the rigidity of the body so that the suitable rigidity according to the collision gestalt is acquired in the vehicle of collision impact-absorption structure.

[0002]

[Description of the Prior Art] Since body rigidity has big influence on driving stability etc., although adopting a high intensity steel plate as the frame member which constitutes the body, increasing board thickness, or preparing a proper place reinforcing materials, and aiming at improvement in body rigidity is made, a car body structure which can absorb collision energy appropriately is simultaneously desired from a viewpoint which heightens the crew protection capacity at the time of a vehicle collision. Since the impact absorption at the time of this collision is mainly performed to the body anterior part by the plastic deformation of the side frame of the right and left which extend in a cross direction, by setting up the rigidity of this side frame appropriately, it can suppress low the deceleration produced into a vehicle room portion, and can ease the shock to crew.

[0003]

[Problem(s) to be Solved by the Invention] However, with the collision gestalt (a partial collision is called hereafter) by which the front face of the body collides with both side frames on either side partially like offset collision to collision external force being distributed with the collision gestalt (a complete collision is called hereafter) with which the front face of the body collides on the whole like a transverse-plane barrier collision, collision external force concentrates on one of the two's side frame. For this reason, in, for example, having set each side frame on either side as the rigidity suitable for the partial collision, rigidity becomes excessive to the impact absorption in a complete collision, and big deceleration arises, and Conversely, constituting from having set it as the rigidity suitable for the complete collision so that the influence rigidity is insufficient at the time of a partial collision, and affect a vehicle room portion since the impact absorption is not enough may become large and the optimal impact absorption may be made with both collision gestalten has a difficult field.

[0004] this invention cancels the trouble of such conventional technology, and is thought out for the purpose of offering the body rigidity control unit for an impact absorption suitable regardless of a collision gestalt being performed.

[0005]

[Means for Solving the Problem] In order to achieve such a purpose, in this invention, it shall have the frame rigidity adjustment means 4 of the right and left with which the side frame 2-3 of the right and left which extend a body rigidity control unit in the cross direction of a vehicle 1 is equipped, respectively and which adjust the rigidity of the side frame of these right and left, and the control means 8 which control operation of a frame rigidity adjustment means on either side according to the collision gestalt judged based on the output of the collision-detection means 5. According to this, it is adjusted to the rigidity to which each side frame on either side was suitable for the collision gestalt with the frame rigidity adjustment means on either side, and a suitable impact absorption becomes possible with any collision gestalt of a complete collision and a partial collision.

[0006] the reinforcement which can displace especially the aforementioned frame rigidity adjustment means between the solid-state-component actuator which consists of a piezoelectric device which generates the load of the sense which is suitable or promotes which restrains the plastic deformation of a side frame, or a magnetostrictor or the position which raises the rigidity of a side frame, and the position which does not influence the rigidity of this side frame -- it is good in it being a member In addition, the same operation can be obtained also by the reinforcement member combined to the side frame through the explosive bolt destroyed according to the active signal from control means.
[0007] in addition, the acceleration sensor which detects the acceleration produced in the cross direction of the body at the time of a collision for the aforementioned collision-detection means, the distortion sensor which detects distortion produced in a side frame etc. at the time of a collision or the side frame accompanying deformation of the body at the time of a collision, and bumper attachment -- it is good to use the displacement sensor which detects the variation rate of the survey point set to the proper place of the bodies, such as a member Among these, what senses acceleration by distortion produced in a mass supporter as an acceleration sensor using the piezoelectric device which outputs a voltage signal by distortion, the semiconductor to which resistance is changed by distortion, or the glass fiber to which a transparency property is changed by distortion can be mentioned. Although the thing which were enumerated by the aforementioned acceleration sensor as a distortion sensor and which was distorted and used detection material can be mentioned, the composition made to serve a double purpose with the solid-state-component actuator which consists of a piezoelectric device or a magnetostrictor is also possible. The limit switch by the thing using the variable resistor as a displacement sensor, the laser displacement gage, and simple gap structure etc. can be mentioned.
[0008]
[Embodiments of the Invention] With reference to an attached drawing, the composition of this invention is explained in detail below.
[0009] Drawing 1 shows the body rigidity control unit by this invention. This body rigidity control unit has two or more electrostrictive actuators 4 as a frame rigidity adjustment means with which each of the side frame 2-3 of the right and left which extend in the anterior part of a vehicle 1 at a cross direction was equipped, the acceleration sensor 5 of the right-and-left couple as a collision-detection means with which each of the side frame 2-3 on either side was equipped, and the controller 8 as control means arranged on the pin center,large frame 7. The side frame 2-3 is comparatively formed in low rigidity to compensate for the complete collision.
[0010] the attachment of an edge by which adhesion fixation was carried out at the skin of a side frame 2-3 at the portion inside the neutral plane of two flections 9-10 in the portion crooked in the shape of [of a side frame 2-3] a crank as an electrostrictive actuator 4 was shown in drawing 2 -- attachment of a member 11-12 and pars intermedia -- it is in the state ****(ed) between members 13, and is prepared in the couple [every] serial the electrostrictive actuator 4 of this couple -- attachment of pars intermedia -- it is arranged in the state which meets the axis of a side frame 2-3 on both sides of a member 13 where passed and it bent in the shape of a typeface
[0011] The electrostrictive actuator 4 consists of a covering object 18 made of an epoxy resin unified by thermocompression bonding so that a copper electrode 16, and these piezoelectric-devices panel 15 and copper electrode 16 of the couple prepared in front reverse side both sides of the rectangle plate-like piezoelectric-device panel 15 which consists of PZT which generates the load according to the applied voltage from a controller 8, and this piezoelectric-device panel 15 might be covered, as shown in drawing 3 in detail. In addition, it is good to prepare the conductive sheet containing nickel between the piezoelectric-device panel 15 and a copper electrode 16, and to prepare a polyimide film in front reverse side both sides of the covering object 18.
[0012] As shown in a controller 8 at drawing 4 , a collision gestalt is judged based on A/D converter 21 of the couple which carries out A/D conversion of the output signal of the

acceleration sensor 5 on either side, and the output signal of A/D converter 21, and it has the switching circuit 24 which impresses the voltage of a power supply 23 to an electrostrictive actuator 4 by the switching operation of a transistor according to the output signal of CPU22 and CPU22 which outputs the actuating signal of the necessary electrostrictive actuator 4 according to the judgment result.

[0013] Thus, in the constituted body rigidity control unit, the output signal of the acceleration sensor 5 on either side is inputted into CPU22 through A/D converter 21, and always, as shown in drawing 5 , the reference value G0 memorized beforehand is compared with acceleration GL-GR which the output signal from each acceleration sensor 5 shows, and the storage section which a controller 8 does not illustrate (Steps 1-3). Here, although judged [be / more than reference-value G0 / both acceleration GL-GR of both on either side] with a complete collision (Step 4), it ends without operating an electrostrictive actuator 4 in this case, and both the side frames 2-3 of the right and left beforehand set comparatively as low rigidity to compensate for the complete collision cause expected plastic deformation, and absorb a shock.

[0014] When both acceleration GL-GR of both on either side is less than a reference value G0, it is judged with a thing without the collision (Step 5), and it ends, without operating an electrostrictive actuator 4 as well as the above.

[0015] On the other hand, if the left acceleration GL is more than reference-value G0 and the right acceleration GR is less than a reference value G0, it will be judged with a left partial collision (Step 6), and supply voltage will be impressed to the electrostrictive actuator 4 prepared in the left side frame 2 (Step 7). On the other hand, the left acceleration GL is less than a reference value G0, and it is judged [be / more than reference-value G0 / the right acceleration GR] with a right partial collision (Step 8), and supply voltage is impressed to the electrostrictive actuator 4 prepared in the right side frame 3 (Step 9).

[0016] Thus, if supply voltage is impressed to the electrostrictive actuator 4 prepared in the side frame 2-3 of one of right and left, in the electrostrictive actuator 4, the extension force as shown by the arrow in drawing 2 will occur. This restrains the compression set produced into the portion in which the electrostrictive actuator 4 was formed, when the collision external force of the direction of an axis shown by Arrow A is inputted into a side frame 2-3, and it acts so that the rigidity of a side frame 2-3 may be raised. therefore, the predetermined side frame 2-3 was suitable for the partial collision -- comparatively -- high -- it will be in a rigidity state and a suitable impact absorption will be made

[0017] In addition, although an electrostrictive actuator 4 shall be operated to the sense which raises the rigidity of a side frame 2-3 here, the composition which operates an electrostrictive actuator 4 contrary to this to the sense to which the rigidity of a side frame 2-3 is reduced is also possible. In this case, the side frame 2-3 is comparatively formed in high rigidity beforehand, when [suitable for the partial collision] judged with a complete collision (Step 4 of drawing 5), it is accepted, and the simultaneous operation of the electrostrictive actuator 4 of both side frames 2-3 is carried out, and it controls to fall even to the rigidity to which the rigidity of both the side frames 2-3 on either side was suitable for the complete collision.

[0018] Drawing 6 shows the example which forms the magnetostriction actuator 31 in the straight-line-like portion of a side frame 2-3 as a frame rigidity adjustment means.

[0019] The magnetostriction actuator 31 consists of a yoke 34 as a **** means to guide the generating magnetic field of the magnetostrictor panel 32 which generates the load according to the intensity of a magnetic field, the exiting coil 33 which generates the magnetic field added to the magnetostrictor panel 32, and an exiting coil 33 to the magnetostriction panel 32. The magnetostrictor panel 32 forms the super-magnetostriction material of common knowledge, such as a Tb-Dy-Fe alloy, in rectangular plate-like one by the forming method of common knowledge, such as casting, logging, sintering, or vacuum evaporationo. a yoke 34 -- electromagnetism -- it being formed by soft magnetic materials, such as steel, and with the magnetic pole section 35-36 of the couple joined to the side edge of the couple with which the rectangle-like magnetostrictor panel 32 disagrees mutually, respectively It consists of an

arm 37-38 of the couple which extended in the same direction from the length direction core of both the magnetic pole section 35-36, and the iron core section 39 to which sheathing of the exiting coil 33 was carried out in the state where it was constructed between the both-arms sections 37.38. In addition, it is good for the field of the magnetic pole section 35-36 which touches a side frame 2-3 to form the magnetic sealing layer which consists of non-magnetic materials, such as Mo and aluminum.

[0020] Here, the mounting hole 40 of the shape of a rectangle established by the peripheral wall of a side frame 2-3 is equipped with the magnetostriction actuator 31, and the operation current from a controller 8 is supplied to the exiting coil 33 through the lead wire 41 inserted in in the side frame 2-3.

[0021] Moreover, it consists of a piezoelectric device etc. as a collision-detection means, and is distorted, the sensor 42 is formed in the peripheral wall of a side frame 2-3, the distortion signal from the distortion sensor 42 is always inputted into a controller 8, and the judgment of a collision gestalt is performed by the controller 8 like the above based on this distortion signal.

[0022] If a control voltage is impressed to an exiting coil 33 from a controller 8 based on the judgment result of this collision gestalt, the load of the sense which suppresses distortion of the peripheral wall of a side frame 2-3 will occur on the magnetostrictor panel 32, and this load will be transmitted to a side frame 2-3 through the magnetic pole section 35-36 of a yoke 34. The generating load of this magnetostrictor panel 32 can suppress deformation of the straight-line-like portion of a side frame 2-3, it can act so that the buckling stress may be increased, and it can acquire necessary rigidity.

[0023] In addition, although the operation gestalt shown in aforementioned drawing 2 differs in the means of attachment and the arrangement position to a side frame 2-3 of each actuator 4-31 of piezo-electricity and a magnetostriction mutually from the operation gestalt shown in aforementioned drawing 6 , these piezo-electricity and both the actuators 4-31 of a magnetostriction have an equivalent function mutually, and a proper combination is possible for them not to mention a reverse mode being possible.

[0024] Drawing 7 shows the example which formed the back up plate 51 in the interior of each side frame 2-3 of hollow right and left as a frame rigidity adjustment means. Here, the end of the back up plate 51 arranged at the abbreviation horizontal direction is ****(ed) by the cantilever formula to the inside of the portion toward which the upper wall 52 of a side frame 2-3 inclined. Near the other end of a back up plate 51, the salient 54 is projected from the inside of the low wall 53 of a side frame 2-3. Close arrangement of the electrostrictive actuator 4 shown in aforementioned drawing 3 and the electrostrictive actuator 55 of abbreviation same composition is carried out at vertical both sides of a back up plate 51, respectively. Each [on either side / 2-side frame 3 / itself] is comparatively formed in low rigidity to compensate for the complete collision.

[0025] If the collision external force of the direction shown by Arrow A is inputted into a side frame 2-3 when a back up plate 51 is in the initial valve position of an abbreviation horizontal direction, deformation of the sense in which the nose of cam of a back up plate 51 and salient 54 are caught and which the wall 52-53 of the upper and lower sides of a side frame 2-3 approaches will be regulated, and the rigidity of a side frame 2-3 will be raised.

[0026] On the other hand, if operating potential is impressed to the up-and-down electrostrictive actuator 55, a shrinkage force will occur in the upper electrostrictive actuator 55, and the extension force will occur in the lower electrostrictive actuator 55, and as a back up plate 51 shows with a fictitious outline all over drawing, it will bend. if collision external force is inputted into a side frame 2-3 in this state, since the nose of cam of a back up plate 51 and salient 54 must have been engaged, a back up plate 51 does not function effectively -- comparatively -- low -- a side frame 2-3 will deform plastically in the rigidity state

[0027] In this case, unlike the control method in the operation form shown in aforementioned drawing 5 , when both acceleration GL-GR of both on either side is judged more than by reference-value G0 to be a complete collision (Step 4 of drawing 5), it is accepted, and the simultaneous operation of the electrostrictive actuator 55 prepared in the back up plate 51 of

the side frame 2-3 on either side is carried out. thereby -- both the side frames 2-3 on either side -- comparatively -- low -- a shock can be absorbed in the rigidity state and the deceleration produced into a vehicle room portion can be suppressed low

[0028] In cases other than this, an electrostrictive actuator 55 is not operated and suppose that a back up plate 51 continues being an initial valve position. if it is one partial collision of on either side by this -- a back up plate 51 -- functioning -- the predetermined side frame 2-3 -- comparatively -- high -- it deforms plastically in the rigidity state and a suitable impact absorption is made

[0029] In addition, the composition made [the position where a back up plate does not function by the initial valve position, but a back up plate functions by the operation of an electrostrictive actuator 55 contrary to the above] to carry out a variation rate is also possible. In this case, what is necessary is just to control like the control method shown in drawing 5 . Moreover, as for an electrostrictive actuator 55, it is possible to also make it it not only to to carry out the variation rate of the back up plate 51, but operate so that the rigidity of back-up-plate 51 the very thing may be raised. Furthermore, the composition which uses the magnetostriction actuator 31 shown in aforementioned drawing 6 and the same magnetostriction actuator for carrying out the variation rate of the back up plate 51 instead of an electrostrictive actuator 55 is also possible.

[0030] Drawing 8 or drawing 10 shows the modification of the operation form shown in drawing 7 . It displaces in the position where a back up plate 61 does not function as a tilting drive is carried out in the upper part by the motor 62 which, as for this back up plate 61, the end is being fixed possible [tilting] to the upper wall 52 of a side frame 2-3 although the back up plate 61 is formed in the flection of a side frame 2-3 like [in drawing 8] the above and abbreviation, and operates in response to the active signal of a controller 8 and a fictitious outline shows in drawing 8 . In addition, it is good also as what carries out the tilting drive of the back up plate 61 instead of a motor 62 by means of a spring. In this case, what is necessary is just to consider as the composition of which the lock means of a spring is canceled in response to the active signal of a controller 8.

[0031] Although the back up plate 63 is being fixed to the side frame 2-3 possible [tilting] like the operation form shown in aforementioned drawing 8 in drawing 9 , the tilting drive of this back up plate 63 is carried out by the magnetic-attraction force produced between the coil 64 prepared in the back up plate 63, and the fixed iron core 65 prepared in the side frame 2-3. In drawing 10 , the step 66 which engages with the point of a back up plate 51 at a low wall 53 is formed instead of the salient 54 in the operation form shown in aforementioned drawing 7 .

[0032] By the way, although a collision form shall be judged with the operation form shown in aforementioned drawing 1 by the difference in the size of the acceleration of the right and left detected by the acceleration sensor 5 on either side, it is also possible to judge a collision form by one acceleration sensor arranged on the body core 7, for example, a center frame. Drawing 11 shows aging of the acceleration produced into the body in the offset by the real vehicle, and each front collision form. With offset and both the front collision form, the change waves of acceleration differ greatly so that clearly from this drawing. That is, in offset collision, how depending on which acceleration starts is late as compared with a head-on collision, and the generating time of a peak has shifted forward and backward with offset and both the front collision form. If a criterion is set up paying attention to this difference, distinction of a collision form is possible. An early judgment is possible if a collision form is judged based on the peak near produced for 8ms especially at the time of a head-on collision. In addition, in case the change wave of the acceleration shown in drawing 11 changes with car body structures and actually sets up a criterion, it will be suitably set up according to the body to which this equipment is applied. Moreover, when judging a collision form by one acceleration sensor in this way, it is also possible to use an acceleration sensor also [thing / of air bag equipment].

[0033] Furthermore, as it has the function which the piezoelectric device itself which makes a solid-state-component actuator is distorted, and outputs the voltage according to the

amount, and it shows the voltage signal corresponding to distortion through the exiting coil to drawing 12 since an output is possible also for a magnetostrictor although the acceleration sensor and the distortion sensor were used as a collision-detection means with the aforementioned operation gestalt, the composition which uses the solid-state-component actuator 71 which consists of a piezoelectric device or a magnetostrictor also [means / collision-detection] is also possible. Here, if the state of the solid-state-component actuator 71 is supervised in the monitor circuit 72 and the distortion beyond a predetermined value is detected, the judgment of a collision gestalt will be performed by CPU22. Other composition is the same as that of what was shown in aforementioned drawing 4 , the active signal of the solid-state-component actuator 71 is outputted from CPU22 based on the judgment result of a collision gestalt, and the voltage of a power supply 23 is impressed to the necessary solid-state-component actuator 71 through a switching circuit 24.

[0034]

[Effect of the Invention] Thus, since according to this invention it is adjusted to the rigidity to which each side frame on either side was suitable for the collision form with the frame rigidity adjustment means on either side and a suitable impact absorption becomes possible with any collision form of a complete collision and a partial collision, the protection capacity of the crew at the time of a collision can be heightened upwards, and a great effect can be done so.

[Translation done.]